

Remarks

Claims 12-13, 26, 28, 79, 111-126, 131-133, 146-148, 150-153 and 155-158 have been canceled. Claims 159-170 have been added.

Support for the newly added claims is in the original claims as filed and the previously considered claims, and the specification at page 4 (lines 9-10), and page 6 (lines 8-10). The new claims are fully supported in Applicant's specification and no new matter has been added.

Applicant requests consideration of the pending claims based on the remarks herein.

Rejection of claims

The Examiner has previously rejected the claims under Section 103(a) as obvious over USP 4,508,591 (Bartlett) in view of USP 6,198,133 (Yamazaki), and as obvious over Bartlett in view of Yamazaki, further in view of USP 6,309,926 (Bell).

In the advisory action, the Examiner stated as follows (emphasis added):

...The examiner only contends that Bartlett discloses the etch solution having HF component and organic acid component. The examiner never contends that Bartlett teaches a 2:1 solution of HF : organic acids...In the final rejection, the examiner acknowledges *that the concentration of each component is a result effective variable...commonly determined by routine experiment...*The examiner still maintains that it would be obvious to perform routine experiments to obtain optimal concentration ratio as an expected result.

The applicants further argue that Bartlett teaches away from the present invention by using NH₄F. The examiner disagrees. *Teaching a way is not teaching away. Teaching another way refers to the fact that a reference teaches a preferred, or an alternative way to claimed way of accomplishing something.*

The claims require (i) a 2:1 (v/v) ratio of hydrofluoric acid and organic acid to provide a pH of about 2-5, or (ii) an about 63-70% by volume of hydrofluoric acid and about 30-36% by volume of organic acid to provide a pH of about 2-5.

The Examiner admits that Bartlett does not disclose Applicant's method as claimed. However, the Examiner maintains the rejection of the claims based on his conclusion that Bartlett discloses an "etch solution having HF component and organic acid component." The Examiner argues that the concentrations of hydrofluoric acid and organic acid are merely a matter of optimization which would require routine experimentation.

The Examiner relies on the rule that discovery of an optimum value of a result effective variable in a known process is *ordinarily* within the skill of the art. However, there are

exceptions to this rule, one of which is noted in *In re Sebek*, 465 F.2d 904, 175 USPQ 93, 95 (CCPA 1972):

The board was convinced that one of ordinary skill in the art would experiment to determine optimum levels of citrus molasses concentration... However, while it may ordinarily be the case that the determination of optimum values for the parameters of a prior art process would be at least *prima facie* obvious, that conclusion depends upon what the prior art discloses with respect to those parameters. Where, as here, the prior art disclosure suggests the outer limits of the range of suitable values, and that the optimum resides within that range, and where there are indications elsewhere that in fact the optimum should be sought within that range, the determination of optimum values outside that range may not be obvious....

Bartlett teaches an etch solution having a significantly *lower* fluorine content— Bartlett teaches a *maximum* amount of 20% by volume of ammonium fluoride (see claim 1) (13% by volume in the Example). The *minimum* amount of HF recited in the claimed subject matter is 63% by volume (see claim 165, for example).

Even if, *arguendo*, the concentrations of HF and organic acid were result effective variables, the Examiner has not identified any basis for optimization that would have resulted in the concentration range recited in Applicant's claims.

The Examiner has not shown any teaching or suggestion in Bartlett to use more than 20% by volume of ammonium fluoride and also has not established why one of ordinary skill in the art would have been led to amounts more than necessary to achieve the desired etch solution taught by Bartlett.

Applicant submits that the use of hydrofluoric acid at concentrations higher than the concentration of 20% by volume of the NH_4F would not be obvious from the Bartlett patent. The Bartlett patent essentially *teaches away from higher concentrations* in its disclosure of prior art etch solutions in which the concentrations of NH_4F , HF, and acetic acid *were varied without success* (at col. 1, lines 43-53, emphasis added):

Prior art solutions to such problems have included: ... (4) *varying the concentration of ammonium fluoride and acetic acid or hydrogen fluoride in the etchant solution*. Each of these attempted solutions has *failed* to resolve the problem of maintaining very narrow line widths to the high degree of uniformity and accuracy demanded by the VLSI process.

That trend away from higher concentrations of fluoride is underscored by Bartlett's further teaching that *dilute* fluoride solutions are used to etch silicon dioxide (at col. 2, lines 53-54, emphasis added):

Etchant baths dissolve SiO_2 in *dilute acidic fluoride solutions*...

Bartlett teaches the outer limits of the range of a suitable concentration of NH_4F (i.e., 20% by volume) and that the optimum resides within that range (i.e., 13% by wt.). The foregoing disclosure in Bartlett further teaches that the optimum should be sought within that range. There is no suggestion in Bartlett of using a fluoride component at a concentration higher than 20% by weight.

The Examiner has not established a *prima facie* case of obviousness in view of the disclosures of Bartlett.

The Examiner further maintains that Bartlett teaches an alternative or equivalent method to the Applicant's method as claimed ("teaching a way is not teaching away"). Here, Bartlett teaches a method for etching silicon dioxide through a conformal resist layer without undercutting of the resist layer. That method involves the use of an aqueous solution of ammonium fluoride and citric acid.

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. A reference may be said to teach away when a person of ordinary skill, upon examining the reference would be led in a direction divergent from the path that was taken by the Applicant.

The claims are directed to a process of removing a dielectric layer from a surface of a substrate in the presence of an organic material layer using an aqueous solution containing a high concentration of hydrofluoric acid — i.e., 2:1 v/v (see claim 159), or 63-70% by volume (see claim 165).

Bartlett's teaching of the use of a dilute acidic fluoride solution and a maximum concentration of 20% by wt NH_4F for etching silicon dioxide to avoid undercutting of the resist layer would not suggest using an etch solution having a 2:1 v/v or 63-70% by volume concentration of HF, and would discourage one of skill in the art from Applicant's invention.

In sum, Bartlett, either alone or combined with Yamazaki and/or Bell, does not teach or suggest Applicant's method as claimed. Accordingly, withdrawal of the rejections of the claims is respectfully requested.

Extension of Term. The proceedings herein are for a patent application and the provisions of 37 CFR § 1.136 apply. Applicant hereby requests an appropriate extension of time

for submission of the accompanying Request for Continued Examination and this Preliminary Amendment. The Commissioner is authorized to charge Account No. 23-2053 if any additional fees are required.

Based on the above remarks, the Examiner is respectfully requested to reconsider and withdraw the rejections of the claims. It is submitted that the present claims are in condition for allowance, and notification to that effect is respectfully requested.

Respectfully submitted,



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